CLAIMS

1. An imaging apparatus, comprising:

a plurality of pixels to detect radiation and to output image signals based on the detected radiation;

a temperature sensor to detect an ambient temperature; and

means, coupled to the plurality of pixels and the temperature sensor, for determining a variation of a calibration parameter of a pixel during operation of the imaging apparatus after an initial calibration procedure.

2. The imaging apparatus of claim 1, wherein the means for determining a variation of a calibration parameter comprises means for determining a variation of an offset of the pixel.

3. The imaging apparatus of claim 1, wherein the means for determining a variation of a calibration parameter comprises means for determining a variation of a gain of the pixel.

4. The imaging apparatus of claim 1, wherein the means for determining a variation of a calibration parameter is actuated to determine the variation of the calibration parameter when a predetermined time period has elapsed.

5. The imaging apparatus of claim 1, wherein the means for determining a variation of a calibration parameter is actuated to determine the variation of the calibration parameter when a predetermined ambient temperature change has occurred.

6. The imaging apparatus of claim 1, wherein the means for determining a variation of a calibration parameter comprises at least one processor, and wherein the at least one processor is programmed to perform an act of:

calculating a variation of an offset calibration parameter for the pixel based on a change in resistance of the pixel over a time period and a change in the ambient temperature of the pixel over the time period.

7. The imaging apparatus of claim 6, wherein the variation of the offset calibration parameter is a change in a resistance of the pixel caused by a change in an ambient temperature of the pixel.

8. The imaging apparatus of claim 1, wherein the plurality of pixels are sensitive to radiation in the infrared range.

9. The imaging apparatus of claim 1, wherein the plurality of pixels are sensitive to thermal radiation.

10. The imaging apparatus of claim 1, wherein the means for determining includes means for determining the variation of the calibration parameter after an initial calibration procedure during which calibration is performed at no more than one calibration temperature.

11. A method of calibrating an imaging system comprising a thermal sensor, comprising an act of:

determining a variation of a calibration parameter of a pixel of the thermal sensor during operation of the imaging apparatus after an initial calibration procedure.

12. The method of claim 11, wherein the act of determining a variation of a calibration parameter includes comparing first and second output signals of the pixel.

13. The method of claim 12, wherein the act of determining a variation of a calibration parameter further includes comparing first and second temperature signals associated with the first and second output signals.

14. The method of claim 11, wherein the act of determining a variation of a calibration parameter includes determining a variation of an offset calibration parameter of the pixel.

15. The method of claim 14, wherein the act of determining a variation of an offset calibration parameter includes determining a change in resistance of the pixel over a time period and a change in the ambient temperature of the pixel over the time period.

16. The method of claim 11, wherein the act of determining a variation of a calibration parameter includes determining a variation of a gain calibration parameter of the pixel.

17. The method of claim 11, wherein the act of determining a variation of a calibration parameter occurs when a predetermined time period has elapsed.

18. The method of claim 11, wherein the act of determining a variation of a calibration parameter occurs when a predetermined ambient temperature change has occurred.

19. The method of claim 11, wherein the act of determining a variation of a calibration parameter includes determining a variation of a calibration parameter of a pixel sensitive to infrared radiation.

20. The method of claim 11, wherein the act of determining includes determining the variation of the calibration parameter after an initial calibration procedure during which calibration is performed at no more than one calibration temperature.

21. A method for generating a gain calibration parameter of a pixel, comprising acts of:

shielding the pixel from scene radiation at a first time and measuring a resistance of the pixel and an ambient temperature at the first time;

shielding the pixel from scene radiation at a second time and measuring a resistance of the pixel and an ambient temperature at the second time; and

calculating the gain calibration parameter using the resistance of the pixel and the ambient temperature at the first time and the resistance of the pixel and the ambient temperature at the second time.

22. The method of claim 21, wherein the act of calculating the gain calibration parameter includes determining a change in the resistance of the pixel between the first and second times relative to a change in the ambient temperature between the first and second times.

23. The method of claim 22, wherein the act of calculating further comprises acts of:

subtracting the ambient temperature at the first time from the ambient temperature at the second time to generate an ambient temperature difference;

subtracting the resistance of the pixel at the first time from the resistance of the pixel at the second time to generate a resistance difference; and

dividing the ambient temperature difference by the resistance difference.

24. The method of claim 21, wherein:

the act of shielding the pixel from scene radiation at the first time comprises performing a shutter operation at the first time; and

the act of shielding the pixel from scene radiation at the second time comprises performing a shutter operation at the second time.

25. The method of claim 21, further comprising acts of:

shielding the pixel from scene radiation at a third time and measuring a resistance of the pixel and an ambient temperature at the third time;

calculating a second gain calibration parameter using the resistance of the pixel and the ambient temperature at the second time and the resistance of the pixel and the ambient temperature at the third time; and

updating the gain calibration parameter with the second gain calibration parameter.

26. The method of claim 21, wherein the pixel is a first pixel in an array of pixels, and wherein the method further comprises:

measuring a resistance of a second pixel in the array of pixel at the first time;

measuring a resistance of the second pixel at the second time; and

calculating a second gain calibration parameter using the resistance of the second pixel at the first and second times and the ambient temperature at the first and second times.

27. The method of claim 21, wherein:

the act of measuring the ambient temperature at the first time comprises measuring a substrate temperature at the first time;

the act of measuring the ambient temperature at the second time comprises measuring a substrate temperature at the second time; and

the act of calculating comprises calculating the gain calibration parameter using the resistance of the second pixel at the first and second times and the substrate temperature at the first and second times.

28. A method of claim 21, further comprising acts of:

receiving scene radiation via the pixel at a third time and measuring an ambient temperature at the third time;

calculating a second gain calibration parameter using the ambient temperature at the third time and a predetermined function that relates an ambient temperature change to a gain calibration parameter change; and

updating the gain calibration parameter with the second gain calibration parameter.

29. The method of claim 21, wherein the pixel is a first pixel in an array of pixels, and wherein the method further comprises acts of:

shielding a second pixel of the array from scene radiation at a first time and measuring a resistance of the second pixel at the first time;

shielding the second pixel from scene radiation at a second time and measuring a resistance of the second pixel at the second time; and

calculating a second gain calibration parameter using the resistance of the second pixel and the ambient temperature at the first time and the resistance of the second pixel and the ambient temperature at the second time.

30. The method of claim 21, further comprising an act of:

applying the gain calibration parameter to correct a gain error of the pixel.

31. The method of claim 30, wherein the act of applying includes applying the gain calibration parameter to an output signal of the pixel to correct the gain error of the pixel.

32. The method of claim 30, wherein the act of applying includes applying the gain calibration parameter to an operating parameter of the pixel to correct the gain error of the pixel.

33. An imaging apparatus, comprising:

a plurality of pixels to detect radiation and to output image signals based on the detected radiation;

a temperature sensor to detect an ambient temperature;

a data storage device to store first and second ambient temperature values and first and second resistance values for each pixel of the plurality of pixels; and

means for calculating a gain calibration parameter for each pixel of the plurality of pixels using the first and second ambient temperature values and first and second resistance values for each pixel of the plurality of pixels.

34. The imaging apparatus of claim 33, further comprising:

a shutter mechanism to block scene radiation;

wherein the first and second ambient temperature values and first and second resistance values for each pixel of the plurality of pixels are each detected during actuation of the shutter mechanism.

35. The imaging apparatus of claim 33, further comprising:

a substrate coupled to the plurality of pixels;

wherein the temperature sensor thermally coupled to the substrate so as to detect a temperature of the substrate.

36. The imaging apparatus of claim 33, wherein the plurality of pixels are sensitive to radiation in the infrared range.

37. The imaging apparatus of claim 33, wherein the plurality of pixels are sensitive to thermal radiation.

38. The imaging apparatus of claim 33, wherein at least some of the plurality of pixels are bolometers.

39. A method, comprising acts of:

determining a gain of the pixel between first and second times;

exposing the pixel to both scene and ambient radiation at a third time;

measuring an ambient temperature of the pixel at the third time; and

calculating an offset calibration parameter of the pixel using the gain of the pixel between the first and second times and the ambient temperature of the pixel at the third time.

40. The method of claim 39, further comprising an act of:

determining a change in temperature of the pixel between the second and third times based solely on a change in scene radiation using the offset calibration parameter and a resistance of the pixel measured at the third time.

41. The method of claim 40, further comprising an act of:

determining a change in temperature of the pixel between the second and third times based solely on a change in scene radiation by multiplying a gain calibration

parameter by the resistance of the pixel measured at the third time to generate a product, and adding the offset calibration parameter to the product.

42. The method of claim 39, wherein the act of calculating the offset calibration parameter includes an act of determining the portion of the resistance of the pixel at the third time that is attributable to ambient radiation.

43. The method of claim 39, further comprising acts of:

shielding the pixel from scene radiation at the first and second times; and

exposing the pixel to ambient radiation and scene radiation at the third time.

44. A method of claim 43, wherein the act of shielding comprises performing a shutter operation at the first and second times.

45. The method of claim 39, wherein the act of determining a gain of the pixel comprises acts of:

shielding the pixel from scene radiation at a first time and measuring a resistance of the pixel and an ambient temperature at the first time;

shielding the pixel from scene radiation at a second time and measuring a resistance of the pixel and an ambient temperature at the second time; and

calculating the gain of the pixel using the resistance of the pixel and the ambient temperature at the first time and the resistance of the pixel and the ambient temperature at the second time.

46. The method of claim 39, wherein the pixel is a first pixel in an array of pixels, and wherein the method further comprises:

determining a gain of a second pixel in the array between the first and second times;

measuring a resistance of the second pixel; and

calculating a change in the resistance of the second pixel between the second time and the third time resulting from a change in the ambient temperature between the second time and the third time.

47. The method of claim 39, wherein:

the act of measuring an ambient temperature of the pixel at a third time comprises measuring a substrate temperature at the third time.

48. The method of claim 39, further comprising an act of:

applying the offset calibration parameter to an output signal of the pixel at the third time to correct an offset error of the pixel.

49. The method of claim 48, wherein the act of applying includes applying the offset calibration parameter to a resistance of the pixel at the third time to correct the offset error of the pixel.

50. The method of claim 48, wherein the act of applying includes applying the offset calibration parameter to an operating parameter of the pixel to correct the offset error of the pixel.

51. An imaging apparatus, comprising:

at least one pixel to detect radiation and to output image signals based on the detected radiation;

a temperature sensor to detect an ambient temperature; and

means for calculating an offset calibration parameter for the at least one pixel using a gain of the at least one pixel between first and second times and an ambient temperature at a third time, wherein the pixel is exposed to both scene and ambient radiation at the third time.

52. The imaging apparatus of claim 51, further comprising:

a substrate coupled to the at least one pixel;

wherein the temperature sensor thermally coupled to the substrate so as to detect a temperature of the substrate.

53. The imaging apparatus of claim 51, wherein the at least one pixel is sensitive to radiation in the infrared range.

54. The imaging apparatus of claim 51, wherein the at least one pixel is sensitive to thermal radiation.

55. The imaging apparatus of claim 51, wherein at least some of the at least one pixel are bolometers.

56. A method of performing an offset and gain calibration procedure after an initial calibration procedure, wherein the calibration procedure comprises acts of:

calculating a gain of a pixel between first and second times;

measuring an ambient temperature of the pixel and a resistance of the pixel at a third time, wherein the pixel is exposed to both ambient and scene radiation at the third time; and

determining a change in temperature of the pixel between the second and third time attributable to solely scene radiation using the gain of the pixel between the first and second times and the ambient temperature and resistance of the pixel at the third time.